
A bioinspired and chemically defined alternative to dimethyl sulfoxide for the cryopreservation of human hematopoietic stem cells.

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Public Summary:

The cryopreservation of hematopoietic cells using dimethyl sulfoxide (DMSO) and serum is a common procedure used in transplantation. However, DMSO has clinical and biological side effects due to its toxicity, and serum introduces variation and safety risks. Inspired by natural antifreeze proteins, a novel class of ice-interactive cryoprotectants was developed. The corresponding DMSO-, protein-, and serum-free cryopreservation media candidates were screened through a series of biological assays using human cell lines, peripheral blood cells, and bone marrow cells. XT-Thrive-A and XT-Thrive-B were identified as lead candidates to rival cryopreservation with 10% DMSO in serum based on post-thaw cell survival and short-term proliferation assays. The effectiveness of the novel cryopreservation media in freezing hematopoietic stem cells from human whole bone marrow was assessed by extreme limiting dilution analysis in immunodeficient mice. Stem cell frequencies were measured 12 weeks after transplant based on bone marrow engraftment of erythroid, myeloid, B-lymphoid, and CD34(+) progenitors measured by flow cytometry. The recovered numbers of cryopreserved stem cells were similar among XT-Thrive A, XT-Thrive B, and DMSO with serum groups. These findings show that cryoprotectants developed through biomimicry of natural antifreeze proteins offers a substitute for DMSO-based media for the cryopreservation of hematopoietic stem cells.

Scientific Abstract:

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